PTO 05-787

German Patent No. 197 05 803 A1

SPRING ELEMENT FOR MOUNTING A BRAKE PAD PLATE FOR A DISK BRAKE

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UNITED STATES PATENT AND TRADEMARK OFFICE
WASHINGTON, D.C. NOVEMBER 2004
TRANSLATED BY THE RALPH MCELROY TRANSLATION COMPANY

FEDERAL REPUBLIC OF GERMANY
GERMAN PATENT OFFICE
PATENT NO. 197 05 803 A1
Offenlegungsschrift

Int. Cl.[6]:	F 16 D 65/097
File No.:	197 05 803.5
Filing Date:	February 15, 1997
Date Laid Open to Public Inspection:	August 20, 1998

SPRING ELEMENT FOR MOUNTING A BRAKE PAD PLATE FOR A DISK BRAKE

[Federelement zur Halterung einer Bremsbelagplatte bei einer Scheibenbremse]

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Publications to be Considered in Determining Patentability:

DE 43 18 744 C1
DE-AS 12 23 633
DE 43 31 633 A1
DE 41 16 502 A1
US 44 87 296

The following particulars are published in the form submitted by the applicant.

The invention pertains to a spring element for the detachable mounting of a brake shoe consisting of a pad support plate and a friction pad on the piston of a hydraulic actuation unit for a disk brake with brake support and floating caliper.

Such spring elements often consist of a spring steel sheet that is fastened to the pad support plate at its central part and engages with two or more arms bent in a circumferential groove formed on the inside of the cup-shaped piston (DE 41 16 502 A1; DE 43 18 744 C1). This design has proven itself, but requires a certain axial installation space in the piston that is not always available or, in order to obtain a compact construction, is to be reduced to such an extent that the bent arms can have only an axial extension that is insufficient for an optimal matching of spring and retaining forces.

Therefore, a spring steel sheet has been proposed in which the arms engage in a circumferential groove on the outside of the piston (DE 196 01 435, not yet published). This

solution brings advantages only if more axial installation space is available on the outside of the piston than on the inside. Since a sealing bellows that demands a certain axial installation space is usually provided between the piston exterior and the cylinder, this condition is met only in exceptional cases.

Accordingly, there exists the problem of proposing a spring element for the application purpose mentioned initially that does not have the aforementioned disadvantages, can be produced economically and permits simple assembly and disassembly of the brake shoe. A tension between the floating caliper and the brake pad support should also be achieved so that a relative motion of these components due to external shocks, with mutual impacts and clattering, can be avoided when the brake is not being operated.

To solve these problems, a spring element of this class is proposed that is characterized in that the spring element consists of a wire spring that engages with a central, partially circular part in an external circumferential groove of the piston and comprises two mirror-symmetrically shaped arms that extend from the central part into the radially outer parts of the pad support plate and that, at their ends, each comprises a part bent radially outward and downward, their shaping and spring force being matched together such that the pad support plate can be pressed axially against the end face of the piston and vertically against the brake support.

The wire spring of the invention can be produced economically and need not be permanently joined to the pad support plate. The piston need not be machined by cutting on the inside. The groove required on the outside can be cut by a simple turning process during the required machining of the piston exterior. The axial installation space required for it is only slightly larger than the diameter of the wire spring. Moreover, the groove in the piston for the wire spring represents an additional throttle point for the heat transfer from the brake shoe to the brake fluid and, unlike known spring elements, there is the additional achievement that the floating caliper, axially movable relative to the brake support, is indirectly pressed against the brake support by means of the wire spring.

It is true that a wire spring for axially pressing a brake support plate against the inside surface of the floating caliper that is arranged parallel to the brake disk has already been proposed (DE 43 31 633 A1); with a central part wound in the manner of a rhombus it extends behind projections on the brake support plate and is supported with outward-extending arms on the outside surface of the floating caliper when it is turned 90° about the projections from the vertical "open position" into the horizontal "closed position." This wire spring is not suitable for the brake shoe arranged on the piston, because the room for movement for the wire spring would have to be provided between piston and pad support plate, which contradicts the desire for saving axial installation space, and because the ordinary arrangement of bolts in such disk brakes would prevent pivoting of the wire spring by 90°. Apart from that, at least one arm in the known wire

spring would have to bend elastically very far outwards if the wire spring is to be pivoted past the outside surface of the floating caliper. There also exists the danger that the rhomboidally wound center part may spring out of its mount behind the projection, and that the pivoting of the wire spring will not lead to a pressing of the axially outer brake shoe against the floating caliper. Furthermore, no initial tension between floating caliper and brake support is achieved.

By contrast, an operationally secure mount between piston-side brake shoe and the end face of the piston, as well as tension between floating caliper and brake support, can be produced very easily with the wire spring of the invention.

Advantageous elaborations of the concept of the invention are described in the subordinate Claims 2-8. Further details will be explained in greater detail on the basis of the embodiment presented in Figures 1 and 2.

Figure 1 schematically shows half a side view, partially in cross section, of the parts of a disk brake that are relevant here,

Figure 2 schematically shows a partial plan view of the disk brake according to Figure 1, also in cross section.

In the illustrations of Figures 1 and 2, all parts that have nothing directly to do with the invention were omitted. That includes the brake disk and the floating caliper surrounding the brake disk at its periphery. These components can be deduced directly from the documents cited regarding prior art and are also familiar to the person skilled in the art. Furthermore, only one half of the mirror-symmetrical parts were drawn in each case.

Arranged on either side of the brake disk, not shown, the illustrated disk brake possesses brake shoes 9, each consisting of a pad support plate 1 and a friction pad placed thereon. Pad support plate 1 has a roughly trapezoidal central part, onto which friction pad 6 is mounted, and hammerhead-shaped outer parts 7 that engage from above in matched recesses 8 of brake support 3 and serve to transfer the braking torques from the brake pad plate to the brake support 3, which is immobile on the vehicle. Piston 2 extends perpendicular to the friction surface of brake pad plate 9 and is guided in a cylinder, not shown, which is functionally a part of the hydraulic actuation unit and is usually formed in one piece with the floating caliper. The floating caliper is ordinarily seated on brake support 3 so as to be axially movable within a bolt guide in the operating direction of piston 2. With regard to further details, the reader is referred to the publications cited with regard to prior art.

Recess 8 in brake support 3 extends at least over the entire operating area of pad support plate 1 axially parallel to the movement direction of piston 2, so that pad support plate 1 can move perpendicular to the brake disk without leaving the guide formed by recess 8.

In the front end of piston 2 facing pad support plate 1, a circumferential groove 5, whose size is matched to the cross section of wire spring 4, is cut, a slight distance from the end face.

This wire spring 4 has a central, partially circular part 4a with which it is engaged with groove 4 [sic; 5] over a peripheral angle of more than 180°. Wire spring 4 is thus fixed in the axial direction. It can rotate about piston 2, however, which assures that both outer parts 7 of pad support plate 1 are subjected to essentially equal vertical forces in the closed position.

Mirror-symmetrically shaped arms 4b extend from partially circular part 4a of wire spring 4 in the direction of the outer parts 7 of pad support plate 1. At their ends, these arms 4b have outward-bent parts 4c (Figure 2) and, adjoining the latter, downward-bent parts 4d (Figure 1).

With an appropriate shape and an appropriate design of the spring forces, a wire spring is thus created which is capable of holding pad support plate 1 in place relative to piston 2, by virtue of the fact that downward-bent parts 4d exert axial forces directed towards piston 2, and also of pressing pad support plate 1 against brake support 3, by virtue of the fact that outward-bent parts 4c exert vertical forces acting on the upper side surface of pad support plate 1.

As a result of the latter-mentioned forces, a direct bracing between pad support plate 1 and brake support 3 is achieved and, indirectly, a bracing as well between the floating caliper and brake support 3, because the reaction forces are transferred via piston 2 and the cylinder to the floating caliper.

With the wire spring of the invention, therefore, not only is the desired fixation of pad support plate 1 onto piston 2 achieved, but simultaneously also a permanently acting bracing between the involved components, so that rattling sounds while the brake is inactive are effectively suppressed. The wire spring is extremely economical in terms of production technology, requires no special fastening to the pad support plate and permits very easy assembly and disassembly of the piston-side brake pad plate 9.

Claims

1. Spring element for detachable mounting of a brake pad plate (9) consisting of pad support plate (1) and friction pad (6) onto piston (2) of a hydraulic actuation unit for disk brake with brake support (9) and a floating caliper, characterized in that the spring element consists of a wire spring (4) that engages with a central, partially circular part (4a) in an external circumferential groove (5) of piston (2) and comprises two mirror-symmetrically shaped arms (4b) that extend from central part (4a) into the radially outward parts (7) of pad support plate (1) and each comprises a part (4c, 4d) bent axially outwards and downwards, their shaping and spring force being matched such that pad support plate (1) can be pressed axially against the end face of piston (2) and vertically against brake support (3).

2. Spring element according to Claim 1, characterized in that arms (4b) of wire spring (4) extend underneath the floating caliper and a distance away from it.

3. Spring element according to Claim 1 or 2, characterized in that arms (4b) of wire spring (4) are braced with their axially outward-bent parts (4c) against the upper lateral surface of pad support plate (1).

4. Spring element according to one of Claims 1-3, characterized in that that arms (4b) of wire spring (4) are braced with their axially downward-bent parts (4d) against the pad-side surfaces of pad support plate (1), which are free of friction coating in the outer areas.

5. Spring element according to one of Claims 1-4, characterized in that the central, partially circular part (4a) of wire spring (4) wraps piston (2) by more than 180°.

6. Spring element according to Claim 5, characterized in that the angle of wrap is dimensioned according to the designed vertical contact pressure between pad support plate (1) and brake support (3).

7. Spring element according to one of Claims 1-6, characterized in that arms (4b) of wire spring (4) are sufficiently elastically deformable, manually or by means of a tool, that pad support plate (1) is detachable from its retention position.

8. Spring element according to one of Claims 1-7, characterized in that the floating caliper is braced via piston (2), or the hydraulic actuation unit and pad support plate (1), against brake support (3).

Fig. 1

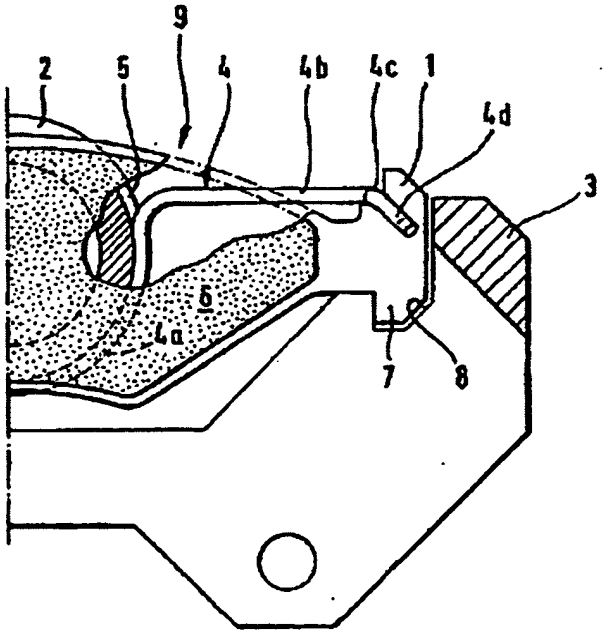

Fig. 2